

## A Far-Infrared Heterodyne Array Receiver for CII and OI Mapping

Completed Technology Project (2012 - 2016)



## Project Introduction

The far-infrared/submillimeter wavelength region of the spectrum (60 - 1000 microns, 0.3 - 5 THz) in astrophysics is dominated by the continuum emission from warm dust with numerous spectral emission and absorption lines of atomic and molecular gas superimposed. A number of large spatial surveys using the Herschel PACS and SPIRE photometers have determined that the dust emission is filamentary in nature at all scales that have been observed. In spite of the universality of the dust structures, large differences in the rates of star formation are observed. The physical processes that give rise to this structure and facilitate the onset of star formation remain the subject of a contentious debate between the effects of turbulence and magnetic fields. Another important open question is the transition between the atomic and molecular phases of the diffuse ISM and how this process determines the characteristics of denser material and how in turn this affects the star formation rate. The velocity structure of atomic and ionized gas associated with dense regions remains largely unknown and can only be obtained through spectroscopy. Separation of components of the ISM requires velocity-resolved atomic, ionic, and molecular line profiles. The recent Decadal Survey has highlighted questions that will require heterodyne technology to resolve, i.e. how do stars form?; how do circumstellar disks evolve and form planetary systems?; what are the flows of matter and energy in the circumgalactic medium?; and what controls the mass-energy-chemical cycles within galaxies?. The focus of this proposal would be to demonstrate a working 16-pixel heterodyne array receiver system. Most components for this system have been demonstrated but a full 16-pixel system needs to be tested to bring this technology to TRL 5. This receiver system enables science beyond HIFI for next generation of heterodyne instruments on platforms like SOFIA.



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## Organizational Responsibility

**Responsible Mission Directorate:**

Science Mission Directorate (SMD)

**Responsible Program:**

Strategic Astrophysics Technology

## Project Management

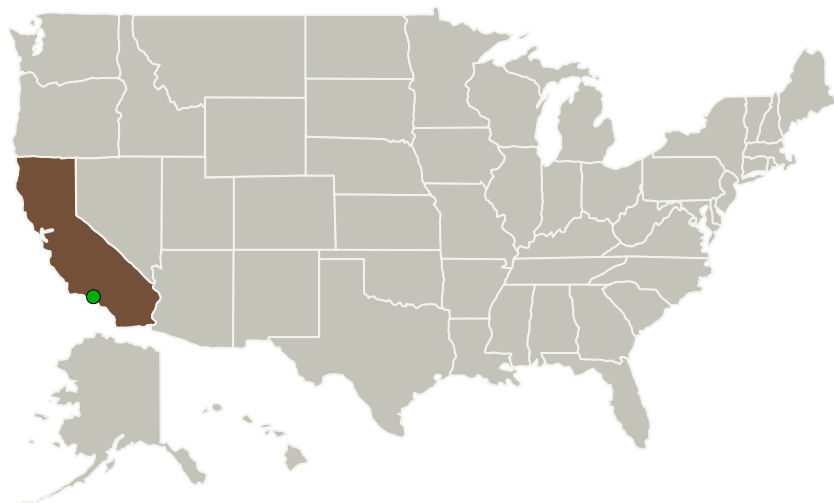
**Program Director:**

Mario R Perez

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

### Primary U.S. Work Locations

California

## Project Management (cont.)

### Program Manager:

Mario R Perez

### Principal Investigator:

Imran Mehdi

### Co-Investigators:

Jonathan H Kawamura

Choon Sup Lee

Jeffrey A Stern

Bruce Bumble

Jose V Siles Perez

Goutam Chattopadhyay

Paul F Goldsmith

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

## Target Destination

Outside the Solar System